FURUNO

OPERATOR'S MANUAL

COLOR SEARCHLIGHT SONAR

MODEL CH − 28

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

©FURUNO ELECTRIC CO., LTD.

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·Your Local Agent/Dealer

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⚠ SAFETY INSTRUCTIONS

"**DANGER**", "**WARNING**" and "**CAUTION**" notices appear throughout this manual. It is the responsibility of the operator of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

⚠ **DANGER**	This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	This notice indicates apotentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.

⚠WARNING



Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

Do not dissasemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

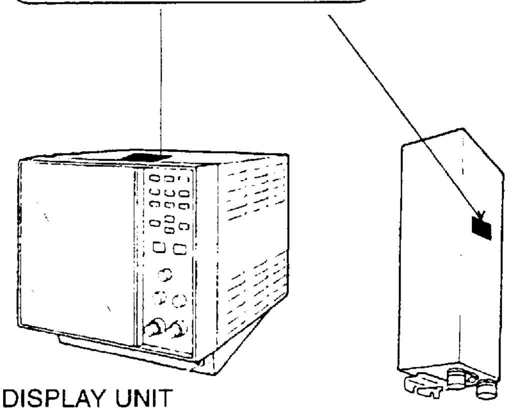
Continued use of the equipment can cause fire, electrical shock or serious injury.

WARNING Label attached

⚠ WARNING ⚠

To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

Name : Warning Label (1)
Type : 86-003-1011-0
Code No. : 100-236-230



⚠ CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not place heater near the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

Do not operate the unit with wet hands.

Electrical shock can result.

Use the correct fuse.

Use of the wrong fuse can cause fire or equipment damage.

Do not exceed speed 15 knots when operating the equipment or during lowering or raising of the transducer.

The transducer may become damaged.

The zinc block attached near the transducer must be replaced yearly.

The junction between the transducer and main shaft may corrode, which can result in loss of the tansducer or water leakage inside the ship.

A WORD TO FURUNO CH-28 OWNERS

Congratulations on your choice of FURUNO CH-28 Color Searchlight Sonar!
We are confident that you will enjoy many years of operation with this fine piece of equipment.

For over 40 years Furuno Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

The CH-28 Color Searchlight Sonar is a microcomputer-controlled up-to-date sonar for small fishing boats developed with our many years of experience and state-of-art technology in the design and manufacture of large sonars. Although the CH-28 is compact and light-weight, it incorporates many useful functions which usually can not be found in this class of sonar and will contribute to modernization and high efficiency of your fishing operation. The excellence of signal processing technique combined with well-suspended sidelobes brings you a high quality 8-color picture on a 10-inch screen.

We would appreciate feedback from you, the end-user, about whether we are achieving our purpose.

Thank you for considering and purchasing Furuno equipment.

Features

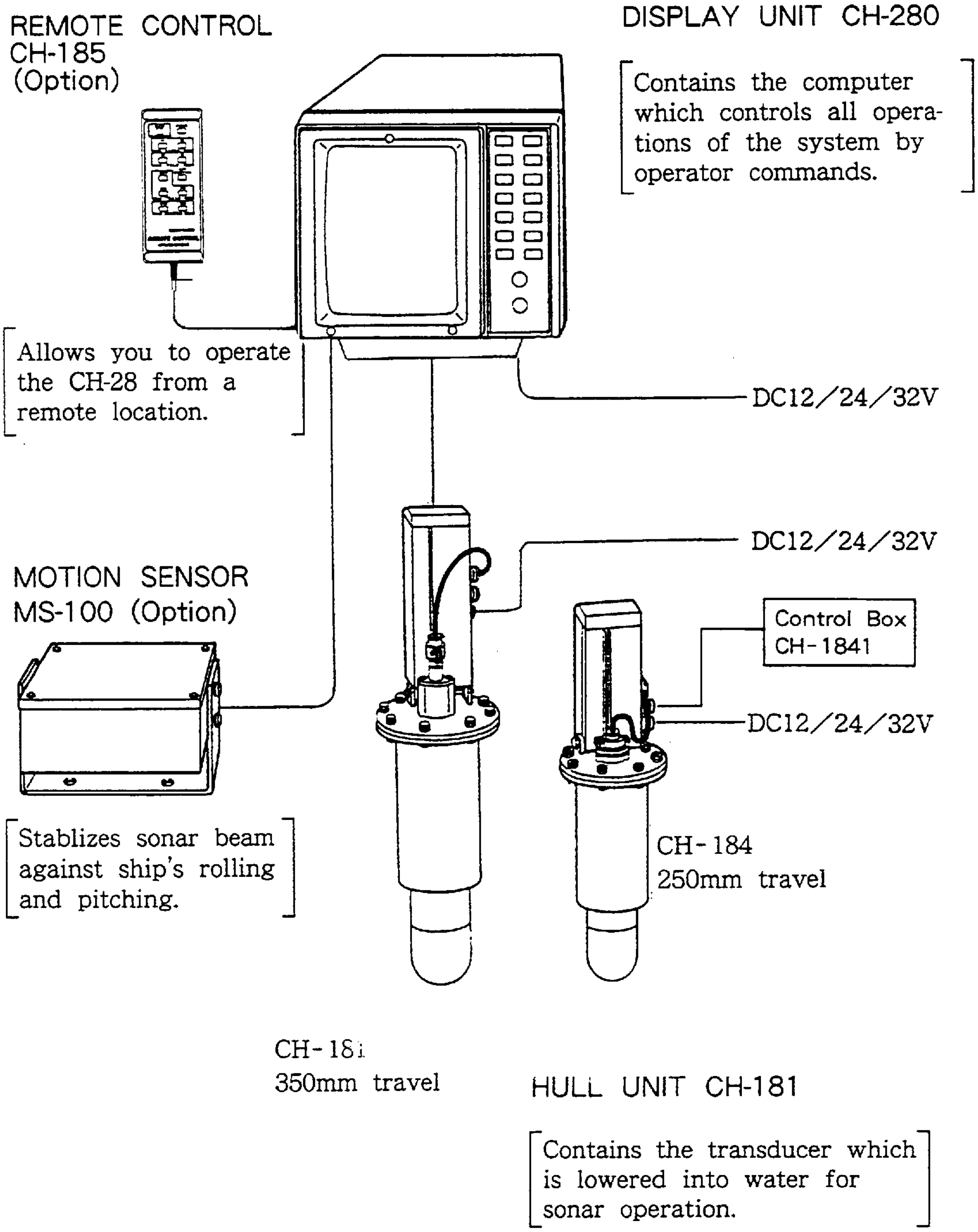
- 10" CRT screen.
- One-touch OFF-CENTER and SCAN REVERSE function largely improves tracking operation for fish echoes.

CONTENTS

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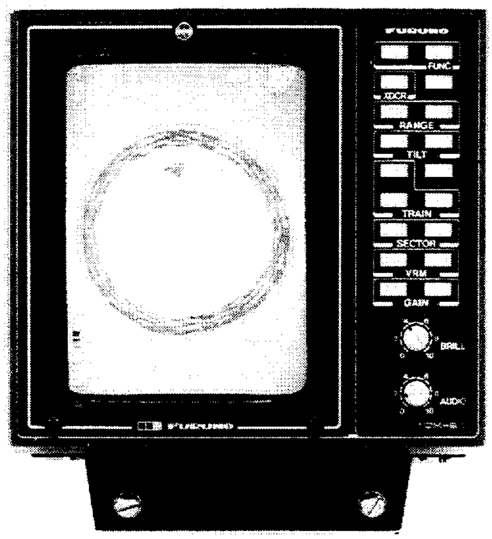
1. SYSTEM CONFIGURATION

The CH-28 consists of the following units.



2. OPERATIONAL CONTROLS

The front part of the display unit is separated into two sections: controls on the right-hand side, and the CRT on the left-hand side. Changing a touchpad setting will cause a corresponding change on the screen as well as a change in the appearance of the echoes being viewed.



OPERATING CONTROL/KEY

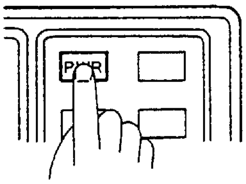
PWR	POWER Key	OFF CENTER	OFF CENTER Key
OFF	OFF (FUNC) Key	↶ ↷	TRAIN Key
↑/↓	XDCR (Transducer) Key	➡⬅ ⬅➡	SECTOR Key
MENU	MENU Key	(−) (+)	VRM Key
− +	RANGE Key	− +	GAIN Key
↑ ↓	TILT Key		BRILLiance Control
SCAN REV	SCAN REVerse Key		AUDIO Control

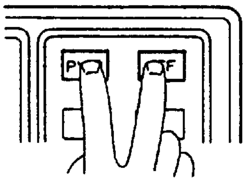
3. BASIC OPERATION

POWER ON/OFF

"ON" "OFF"

Press [PWR] key. Press both [PWR] and [OFF] keys simultaneously.





⚠ CAUTION

Do not exceed speed 15 knots when operating the equipment or during lowering or raising of the transducer.

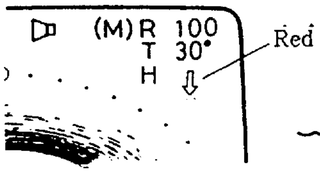
The transducer may become damaged.

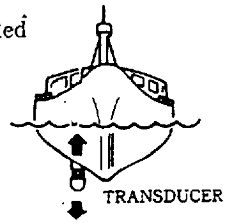
TRANSDUCER RAISE/LOWER

Lower the transducer to use the sonar and retract it into the tank after use.

"LOWER"

Press [↑/↓] (XDCR) key.

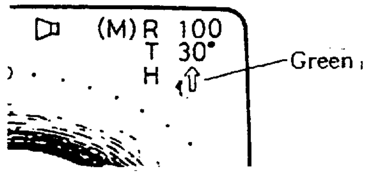




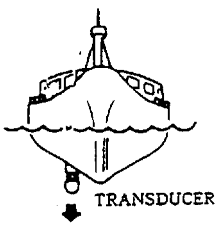
The "⇩" indication flickers while lowering the transducer and lights in red when completed.

"RAISE"

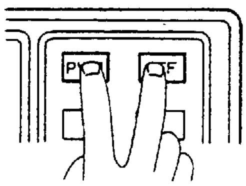
Press [↑/↓] (XDCR) key again.



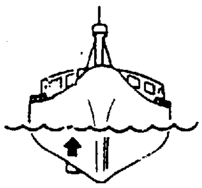
The "⇧" indication flickers while raising the transducer and lights in green when completed.



⇨



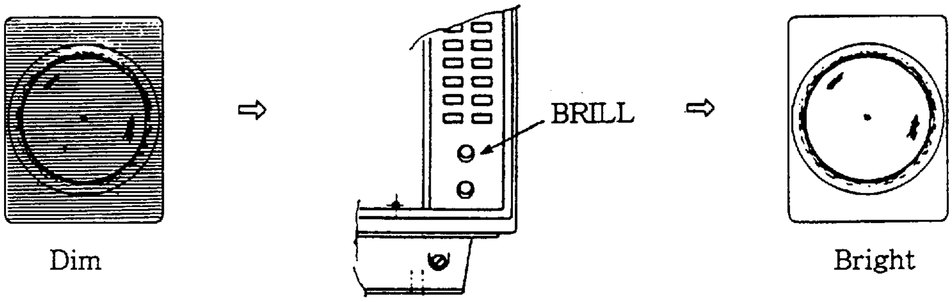
⇨



While the transducer is lowered. | Even if the power is turned off. | The transducer is automatically retracted.

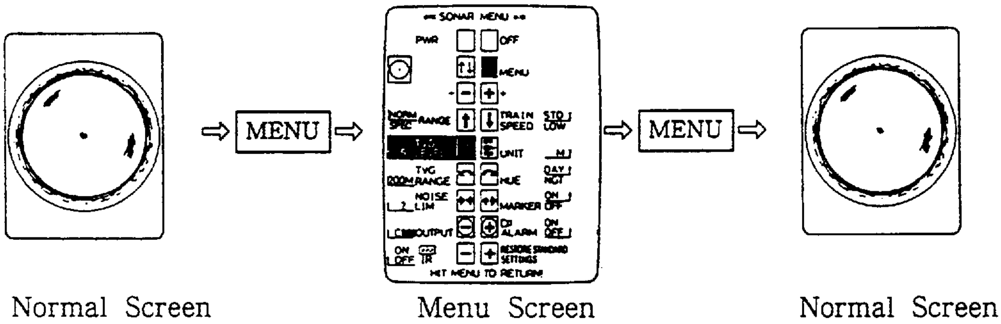
BRILLIANCE ADJUSTMENT

The screen brightness is adjustable with the BRILL control.



NORMAL/MENU SCREEN SELECTION

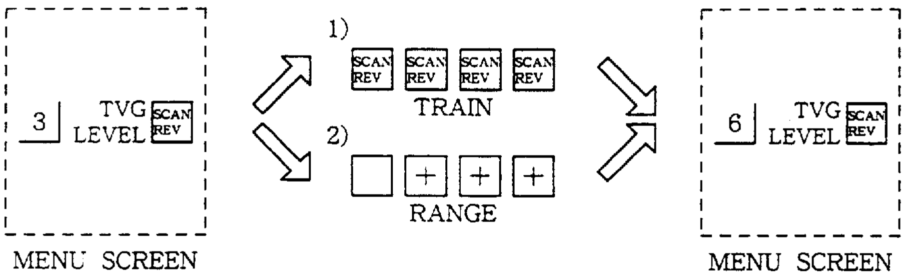
Every pressing of the [MENU] key changes the screen selection between normal and menu.



KEY OPERATION ON MENU SCREEN

The settings on the menu screen can be changed either by
1) pressing the corresponding control key repeatedly.
2) pressing the corresponding control key once and then the RANGE [+] [−] keys.

(EXAMPLE) To change TVG LEVEL.

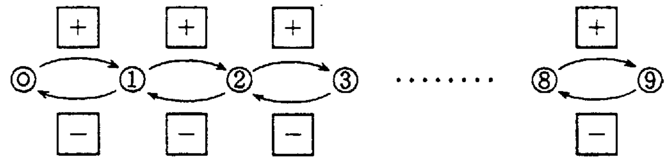


○ Difference Between The Two Methods

1) When only a control key is used, the settings can be changed in one direction.

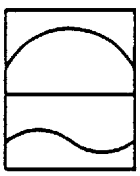
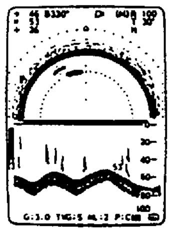
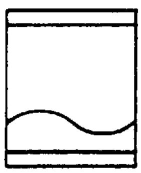
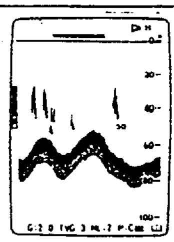
⓪→①→②→③→·······→⑨ (→ back to ⓪)

2) When the RANGE [+] and [−] keys are used, the settings can be changed in both directions.

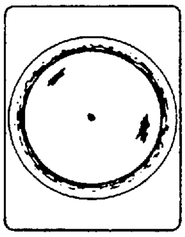


PICTURE SELECTION

In addition to the normal PPI sonar picture, the following two pictures are available as secondary pictures and one of them which has been pre-selected on the menu screen can be displayed by pressing the [OFF] (FUNC) key at any time.

SONAR MODE	 PPI + Historical		Historical picture is plotted on lower half of the screen.
V/S MODE	 Vertical Sounding		The transducer is tilted 90° and the CH-28 works as vertical sounding echo sounder.

Every pressing of the [OFF] (FUNC) key alternates the normal PPI and the preselected secondary picture.

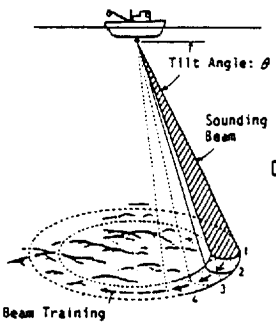


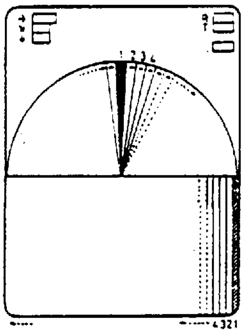
⇨ [OFF] ⇨ (FUNC)

⇦ [OFF] ⇦ (FUNC)

PPI + Historical or Vert. Sounding

Historical Picture

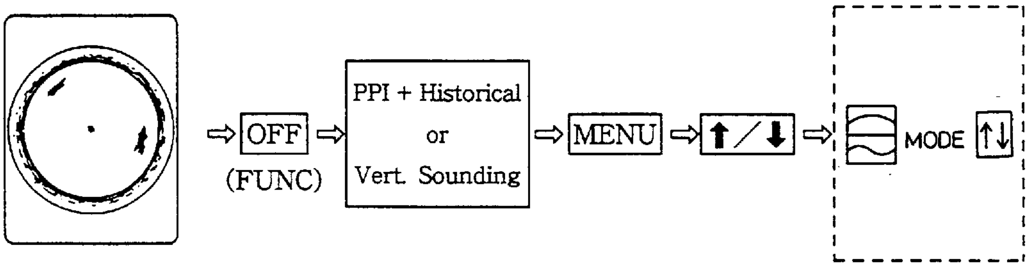




The historical picture can be considered as an echo sounder picture with a tilted transducer. It plots as many as 3 complete circles of sonar picture, allowing you to recognize fish movement and reef contour which are normally difficult to discern on the momentary PPI display.

PRE-SETTING OF SECONDARY PICTURE

The secondary picture which is displayed with the [OFF] (FUNC) key can be preset as follows on the menu screen.



Menu Screen

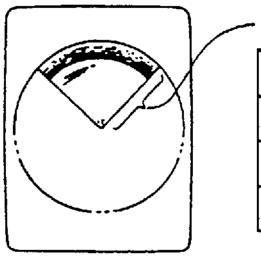
NOTE : To preset a secondary picture, the [MENU] key should be pressed when a picture other than the normal PPI is being displayed.

4. SONAR MODE OPERATION

(NORMAL PPI, PPI + HISTORICAL)

PICTURE RANGE SELECTION

The picture range may be selected with the RANGE [+][−] keys from the 11 ranges listed below.

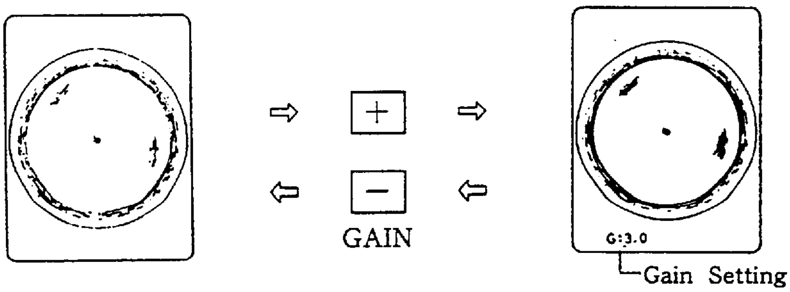


Picture Range

	1	2	3	4	5	6	7	8	9	10	11
Meter	10	20	40	60	100	150	200	250	300	400	600
Foot	30	60	100	200	300	400	600	800	1000	1200	2000
Fathom	5	10	20	40	60	80	100	120	150	200	300

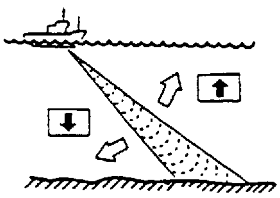
GAIN ADJUSTMENT

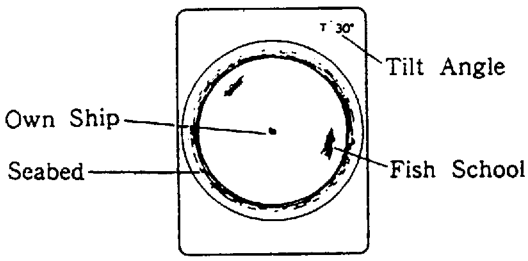
The picture (receiver) sensitivity is adjustable with the GAIN [+][−] keys from "0" to "10" in steps of 0.5. Normally it is used at "5" position.



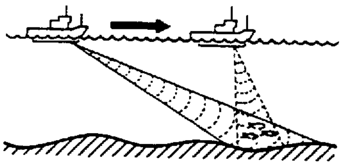
TILT ADJUSTMENT

The sounding direction (tilt angle of the transducer) may be set with the [↑][↓] keys : 0° for horizontal and 90° for vertical directions. It is normally set so that the seabed echoes appear near the screen edge.





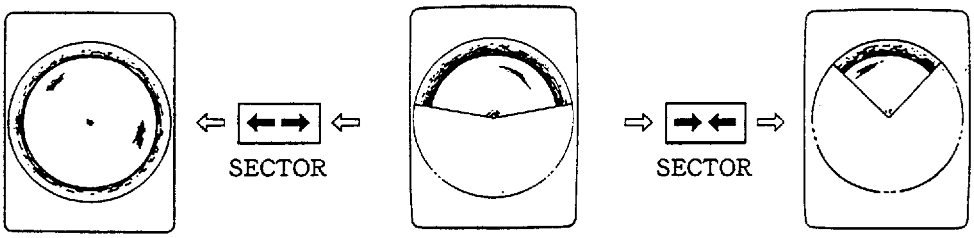
Tilt angle should be kept adjusted



The tilt angle should be continually adjusted after a fish school is detected so as not to miss it as the ship moves.

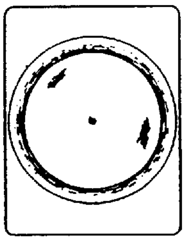
SEARCH AREA SETTING

The search area can be set with the SECTOR [←→] [→←] keys from 6° to 360° in 8 steps.

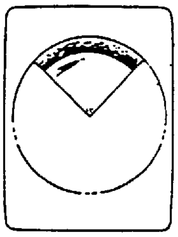


Selecting Appropriate Search Area

The search time depends on the width of the search area. Select an appropriate width to serve the desired purpose.



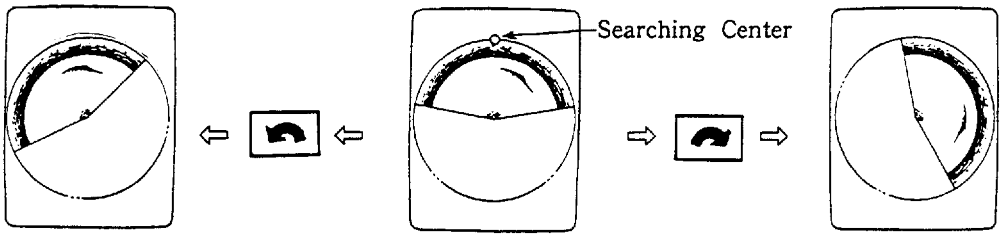
Full circle search until a fish school is detected.
Time required to search 360° is 27 secs on 300m range.



Narrow search area for tracking fish school and secking reefs.
Time required to search 96° is 7 secs on 300m range.

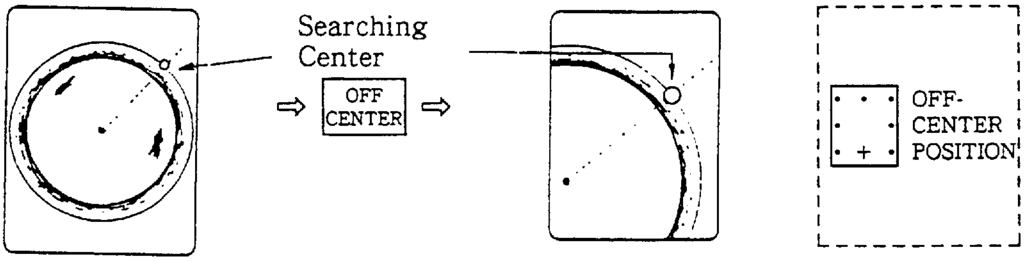
SEARCH DIRECTION SETTING

When the detected fish school moves out of the present search area, change the direction of the search area with the TRAIN [↶] [↷] keys. The center direction of the area is displayed with the "○" mark.



EXPANDING NORMAL PPI PICTURE

The normal PPI picture may be expanded by the [OFF CENTER] key in 45° steps to 8 directions on the screen. A center of display shifts to the opposite of the searching center.

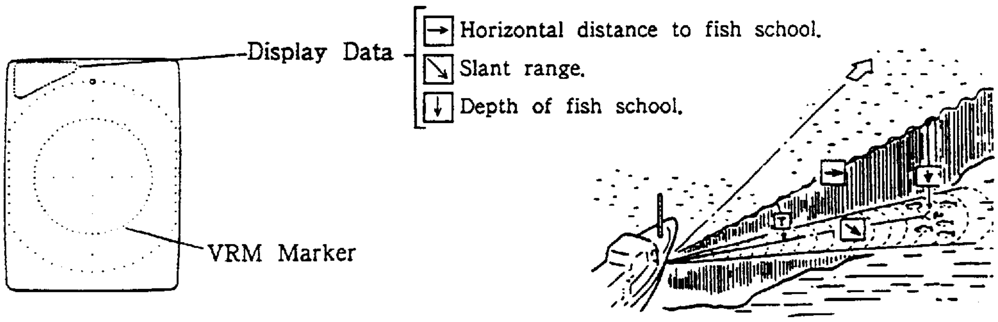


Press the [OFF] (FUNC) key to return the normal PPI picture.

NOTE : OFF-CENTER key functions only on the normal PPI screen.

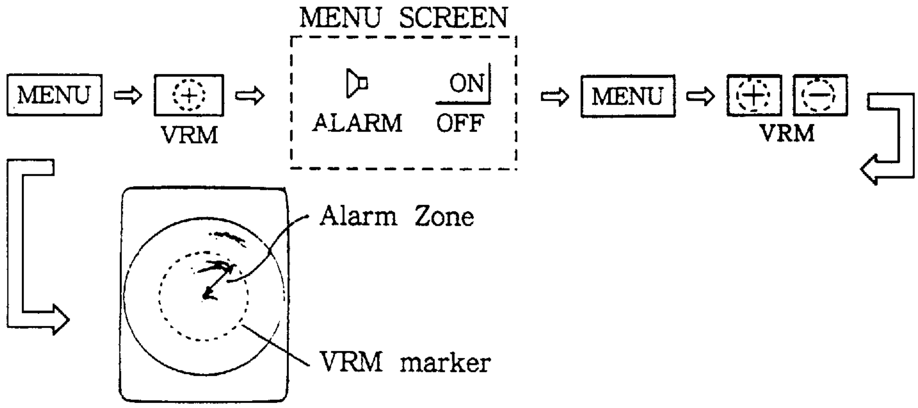
MEASURING RANGE TO FISH SCHOOL

To measure range to a fish school (target), move the VRM (Variable Range Marker) marker onto the fish school with the [+] and [−] keys of the VRM switch.



DETECTING A FISH SCHOOL WITH ALARM FUNCTION

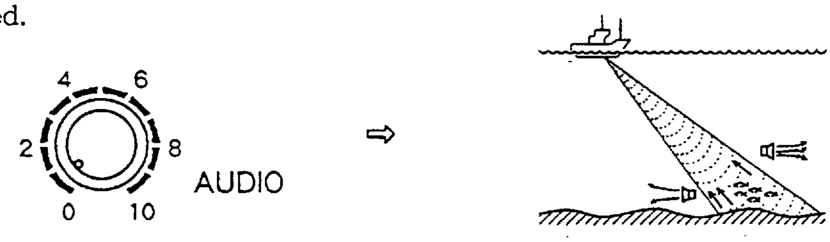
When you are occupied with other tasks and unable to concentrate on watching the picture, use the alarm function. The alarm function enables you to aurally detect a fish school appearing in a predetermined zone through the loudspeaker. The alarm zone is set with the VRM marker as shown below.



The audio alarm is triggered by echoes displayed in red and reddish brown regardless whether they are from a fish school or seabed.

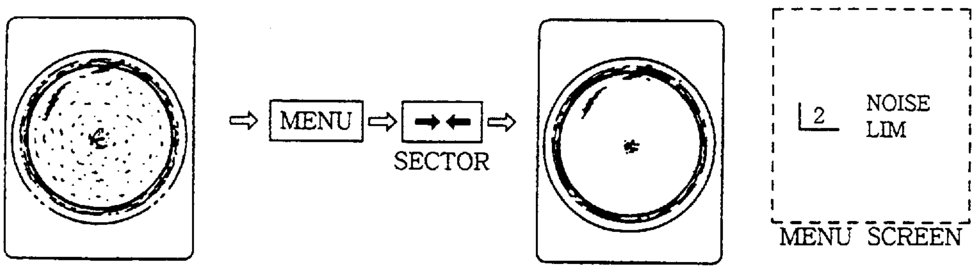
UTILIZING AUDIO FOR FISH DETECTION

In addition to the alarm function mentioned above, the audio from the external loudspeaker can be used for fish detection. Since echoes from fish school generally sound in a different tone, it would become possible to detect a fish school from a range longer than that detected on the display when you are accustomed to using this audio function. Note that in case of the alarm function, the tone is the same for both fish school and seabed.



ELIMINATING LOW LEVEL NOISE

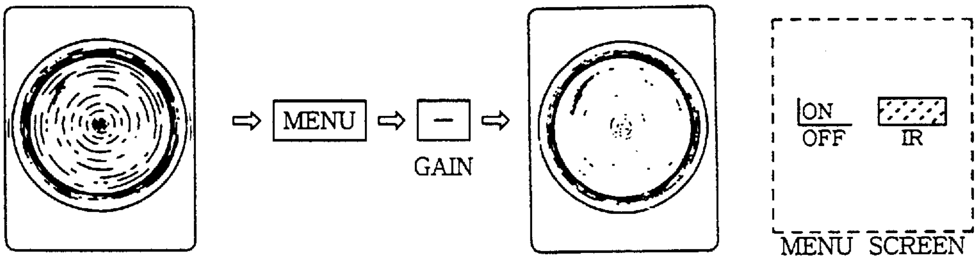
When low level noise appears over an extended area of the screen, mainly due to contaminated water, use the NOISE LIMiter function to eliminate it.



Usually set it to "2" or "3". Too high a setting causes weak echoes (displayed in green or light blue) to go undetected.

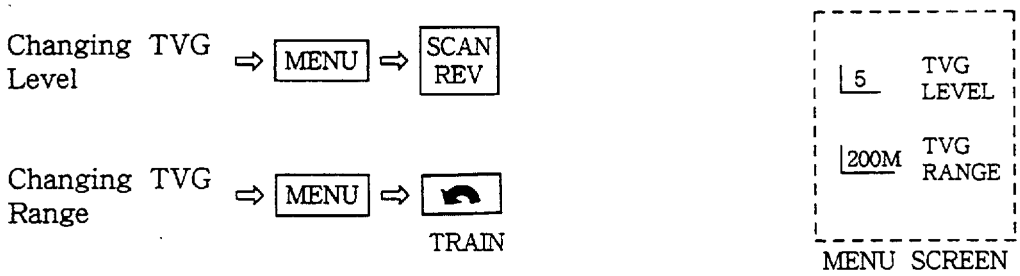
ELIMINATING INTERFERENCE

When interference from other acoustic equipment operating nearby or other electric equipment can be seen on the screen, use the IR (Interference Rejection) function.



CHANGING TVG SETTING

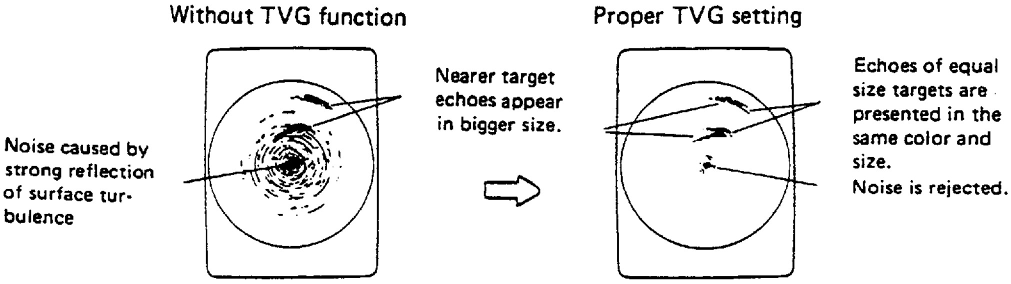
The TVG setting can be changed on the menu screen.



The standard setting is "5" for TVG level and "200m" for TVG range.

HOW TVG WORKS

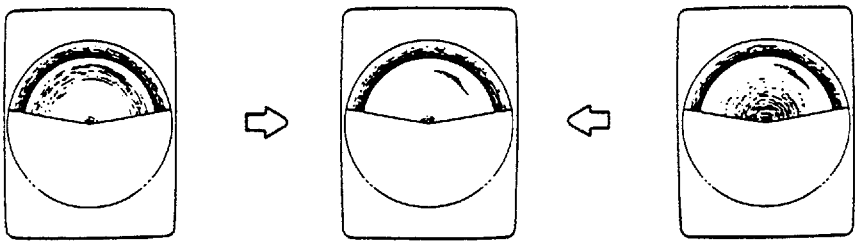
The TVG compensates for receiver gain in accordance with distance in order to suppress noise caused by sea surface reflections and to display the echoes of equal size targets in the same color.



The TVG range and level may be adjusted as follows.

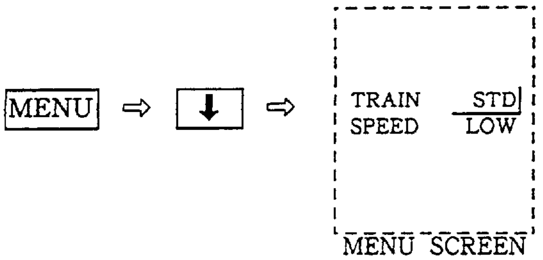
Adjust TVG range.

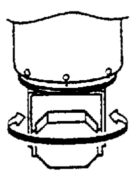
Adjust TVG Level.



CHANGING TRAIN SPEED

Two train speeds (rotation speed of transducer) are available and either of them can be selected on the menu screen.

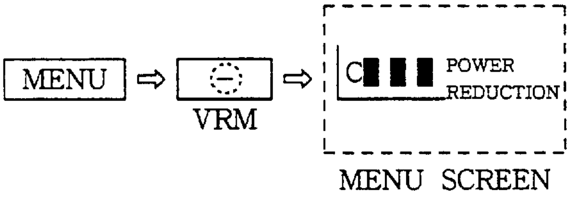




The standard speed is recommended for quick searching of a wide area and to track fish schools which swim fast. In the low speed setting, higher sensitivity can be expected.

REDUCING OUTPUT POWER

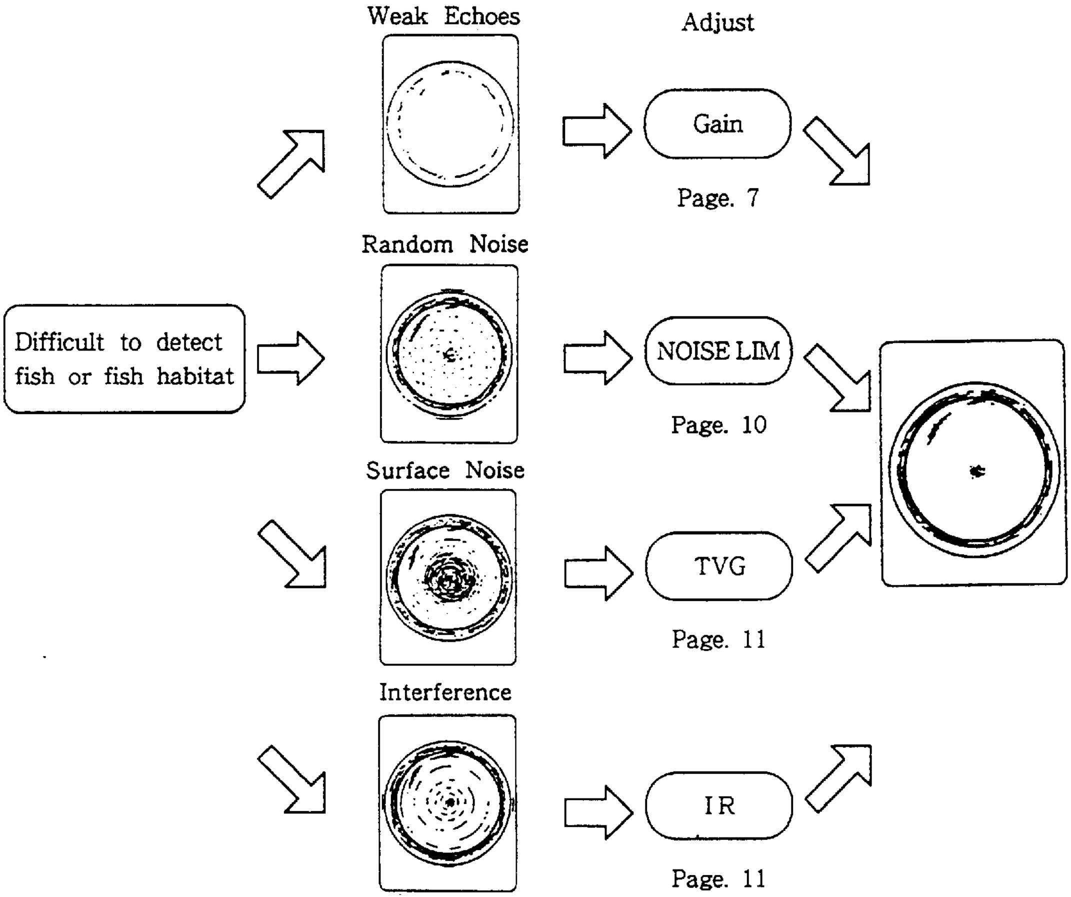
When many ships are operating nearby and operating echo sounders or sonars at the same frequency as the CH-28, it is recommended that the output power be reduced to avoid mutual interference.



INDICATION	OUTPUT
C ▮▮▮	Full Power
B ▮▮	Power 1/10
A ▮	Power 1/100

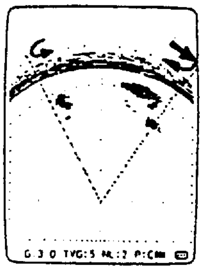
HOW TO OBTAIN QUALITY PICTURE

Most of poor detecting range complaints result from improper settings of keys. For example, fish, fish habitat can not be readily detected by merely increasing the gain. Adjust appropriate settings by carefully studying the picture.



TRACKING ECHOES QUICKLY

Press the [SCAN REV] key to reverse the sounding direction for quick tracking. This function is quite useful for quick confirmation of echoes. In a wide sector selection, target echoes may be lost until the sounding beam returns.



Training direction is reversed whenever the [SCAN REV] key is pressed.

5. VERTICAL SOUNDING (V/S) MODE OPERATION

- This mode can be used even while the transducer is retracted into tank.

PICTURE RANGE SELECTION

The picture range may be selected with the RANGE [+][−] keys from the 11 ranges listed below.

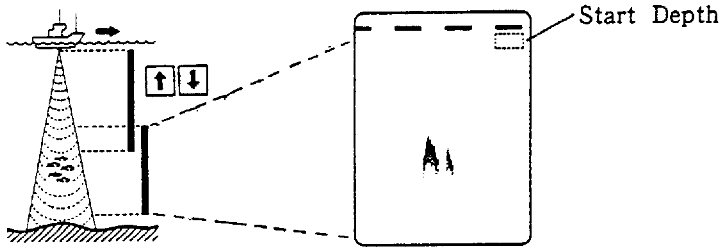


Picture Range

	1	2	3	4	5	6	7	8	9	10	11
Meter	10	20	40	60	100	150	200	250	300	400	600
Foot	30	60	100	200	300	400	600	800	1000	1200	2000
Fathom	5	10	20	40	60	80	100	120	150	200	300

RANGE PHASING

The range phasing is to shift the start depth of the picture displayed on the screen. It can be shifted in steps of 1/5 of the picture range with the TILT [↑][↓] keys.



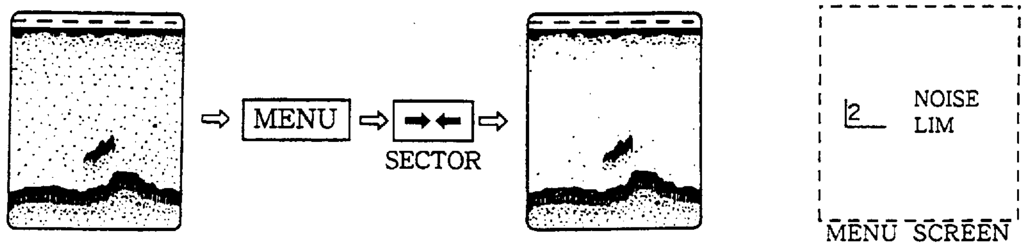
GAIN ADJUSTMENT

The receiver sensitivity is adjustable with the GAIN [+][−] keys. Set it to the point just below where excessive noise appears on the screen. Normally it is set around "5".



ELIMINATING LOW LEVEL NOISE

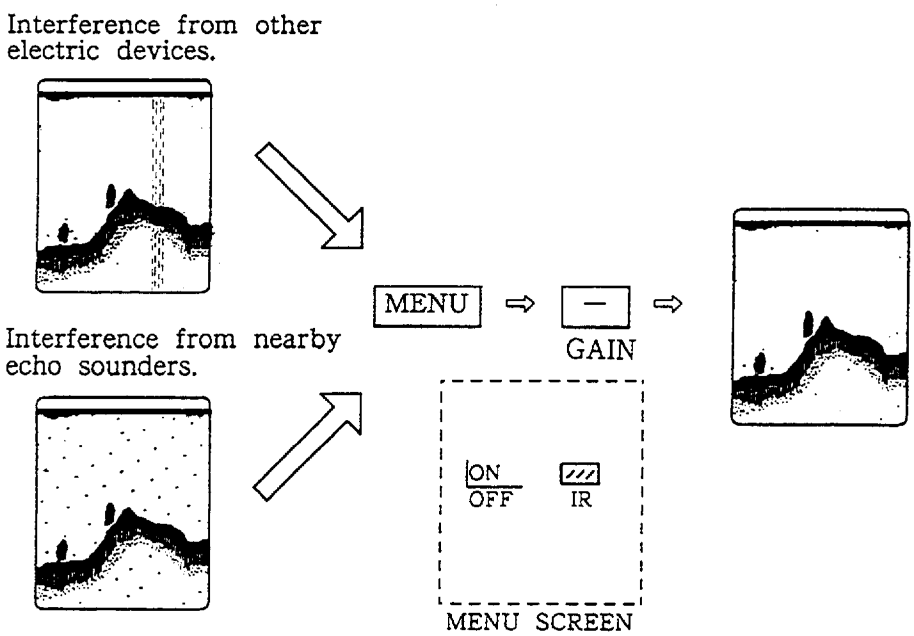
When blue dots appear on the whole screen, mainly due to contaminated water, use the NOISE LIMiter function.



Normal setting is "2" or "3". Too high a setting causes weak fish echoes to be eliminated.

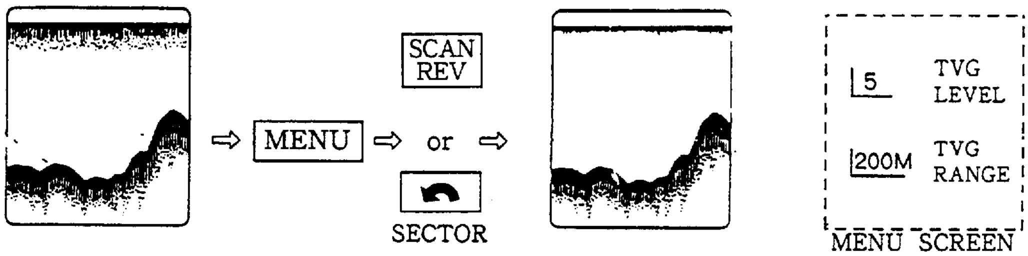
ELIMINATING INTERFERENCE

When interference from other acoustic equipment operating nearby or other electric equipment can be seen on the screen, use the IR (Interference Rejection) function.



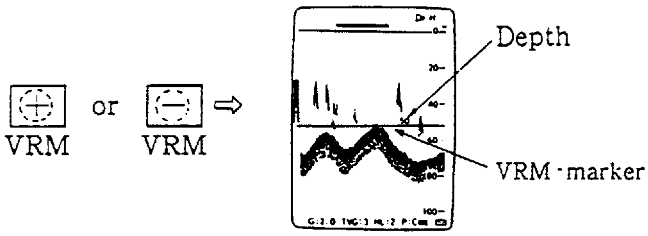
ELIMINATING SURFACE NOISE

When surface noise masks a shallow target, adjust the TVG settings on the menu screen. In addition to suppressing surface noise, the TVG works to compensate for propagation loss of sound so that the echoes from the same size fish schools are displayed in the same color.



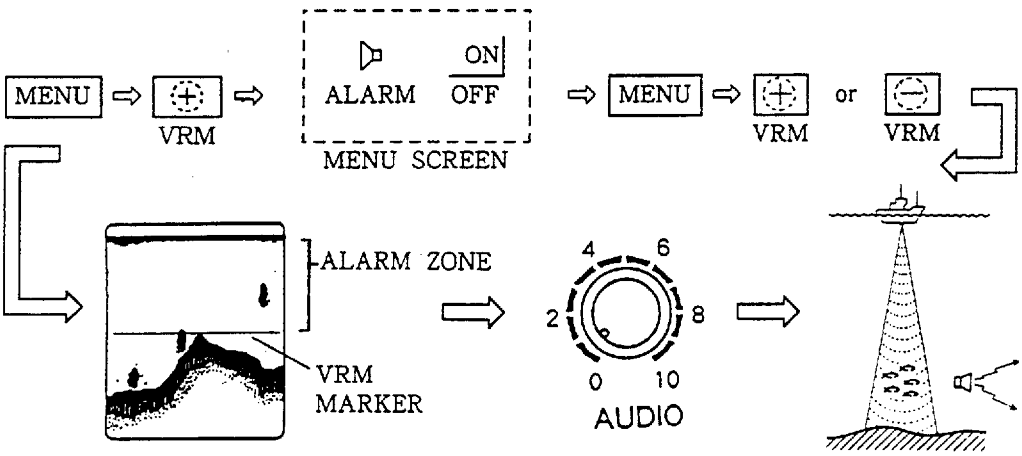
MEASURING DEPTH OF A FISH SCHOOL

To measure the depth of a fish school accurately, use the VRM marker.



DETECTING A FISH SCHOOL AURALLY

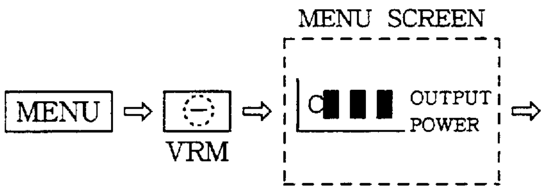
The alarm function enables you to aurally detect a fish school appearing in a predetermined zone through the loudspeaker. The alarm zone may be set with the VRM marker.



The audio alarm is triggered with echoes displayed in red or reddish brown regardless whether they are from a fish school or seabed.

REDUCING OUTPUT POWER

When many ships are operating nearby and operating echo sounders or sonars at the same frequency as the CH-28, it is recommended that the output power be reduced to avoid mutual interference.



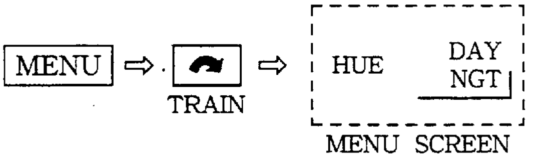
INDICATION	OUTPUT
C ▮▮▮	Full Power
B ▮▮	Power 1/10
A ▮	Power 1/100

6. OPERATIONS COMMON TO SONAR AND VERTICAL SOUNDING MODES

- The following settings are common to both sonar and vertical sounding modes and can be changed on either menu screens.

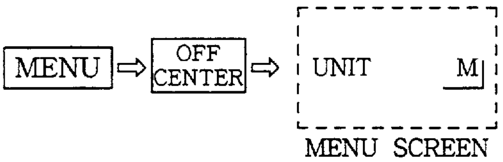
BACKGROUND COLOR SELECTION

The background color can be changed for day and nighttime operations ; blue for day and black for night.



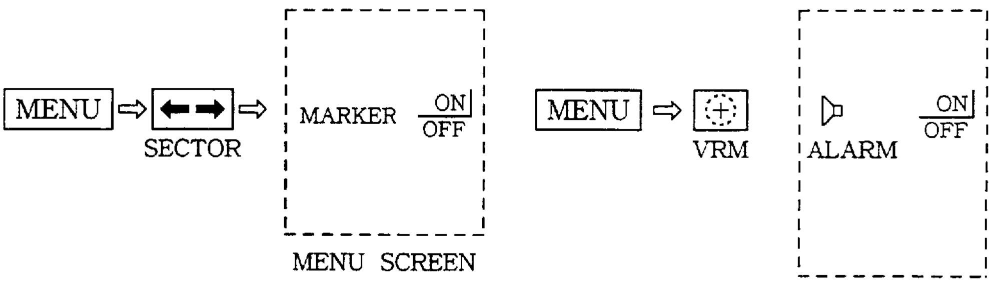
UNIT SELECTION

The unit of range and depth display can be selected among meter (M), foot (FT) and fathom (FA).



ON／OFF OF VRM MARKER

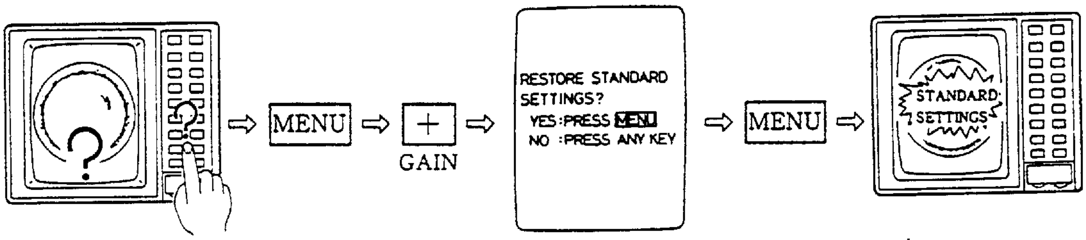
The VRM marker can be turned on／off on the menu screen with the VRM [⊕] key.



7. USEFUL FUNCTION

RESTORING TO STANDARD SETTING

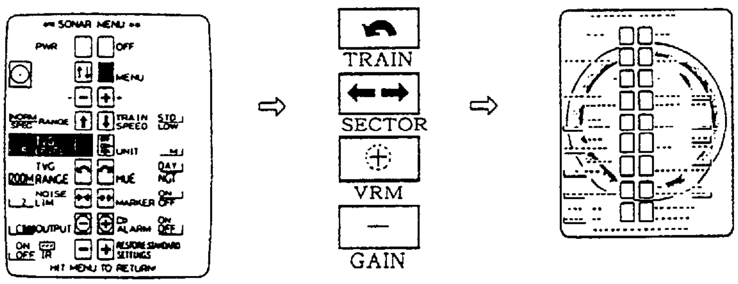
When you are lost in operation and unable to restore the desired picture, try to press [MENU] and GAIN [+] and then [MENU] keys, and all settings on the menu screen are returned to the standard setting.



Note that only the settings on the displayed menu screen are reset.

SETTING MENU SCREEN WHILE OBSERVING PICTURE

When the TVG, NOISE LIM, IR or OUTPUT item is selected on the menu screen, the sonar picture is automatically superimposed and the settings can be adjusted while observing it.



In the menu screen of the vertical sounding mode, the picutre is always displayed at the left 15% of the screen.

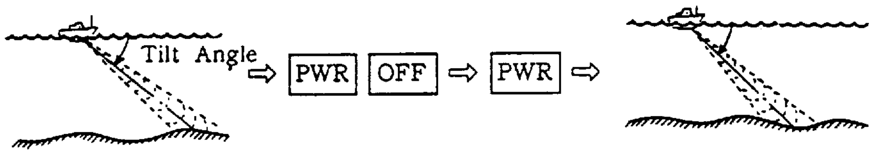
SONAR MODE SETTINGS ARE INDEPENDENT OF VERTICAL SOUNDING MODE SETTINGS

The settings are mutually independent on the sonar and vertical sounding modes and therefore even if the gain is, for example, adjusted on the sonar mode, the gain of the vertical sounding picture is unaffected.

SWITCH SETTINGS ARE REMEMBERED

Since most of the switch settings are remembered in the memory while the power is off, your CH-28 operates in the same settings when used in the next time.

(Example)

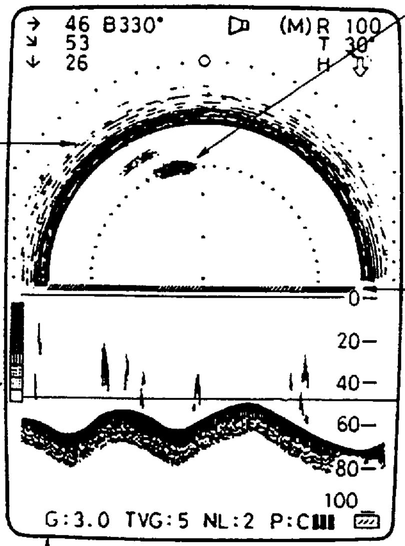


OFF and ON   Angle not changed

8. INTERPRETING THE PICTURE

SONAR MODE

PPI+Historical Display



FISH
Size and color of echo give information on volume and density of fish school. Reddish brown echo indicates densest fish school.

SEABED
Generally seabed echo is displayed in reddish brown thru yellow. Color is an indicator of bottom hardness.

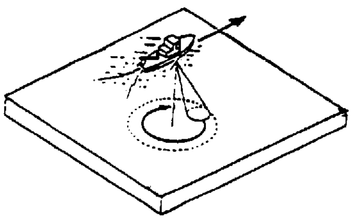
COLOR BAR
Echo intensity is referenced to color gradation. Reddish brown is the strongest.

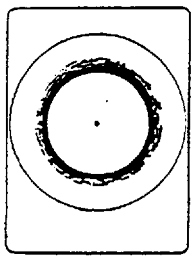
PORT／STARBOARD MARK
It is displayed in green while searching starboard side and in red for port side and used to observe historical picture.

Gain(G), TVG Level, Noise Limiter(NL), Output Power (P) and Interference Rejector (▨) settings.

SEABED

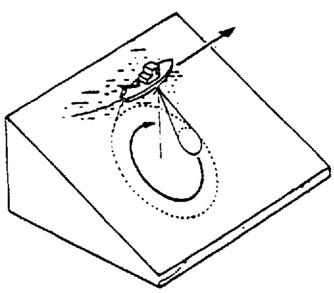
Flat Seabed

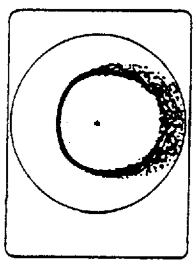




A flat seabed is displayed circularly unless the ship rolls and pitches.

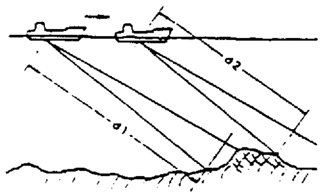
Slanted Seabed

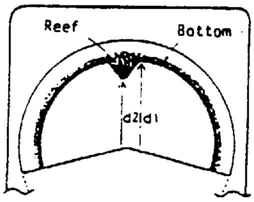




A slanted seabed is displayed ovally ; shallower side in a strong echo color with a shorter tail and deeper side in a weak echo color with a longer tail.

Reef or Wreck

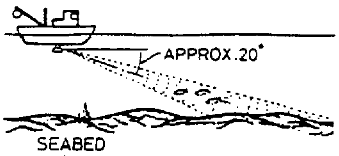


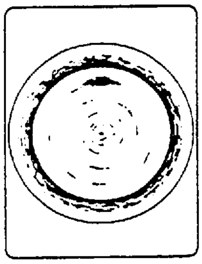


A reef or wreck is displayed in red or reddish brown as a part of the seabed protruded inward, when detected at the lower part of the beam.

FISH

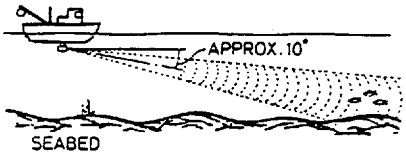
Deep Tilt Angle

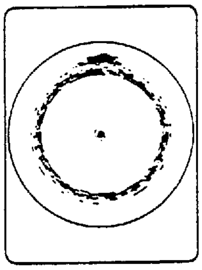




Since the seabed is displayed in strong echo colors, only the fish appearing before the seabed echo can be detected.

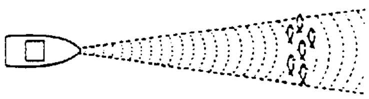
Shallow Tilt Angle

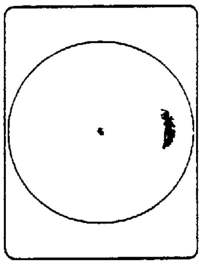




The seabed is displayed in weak echo colors and fish echoes among seabed echoes become discernable, longer range detection becoming possible.

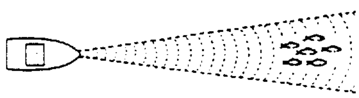
When Beam Hits Side of Fish

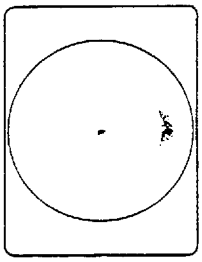




Since fish return strong echoes, they are displayed in strong echo colors. A long detection range can be expected.

When Beam Hits Head/Tail of Fish

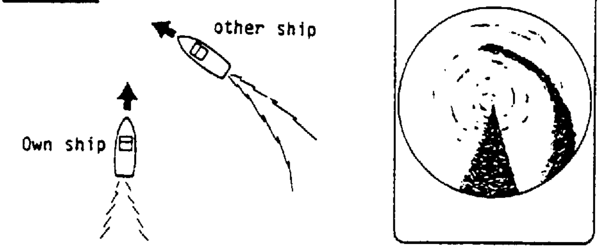




Fish return weak echoes and therefore detecting range is limited.

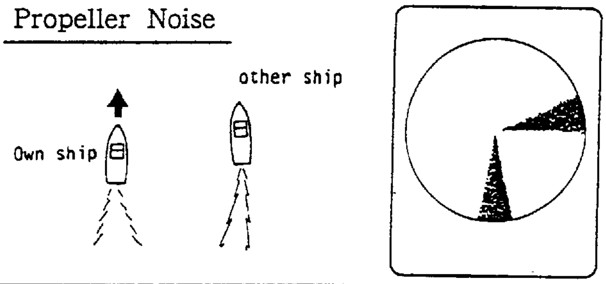
UNWANTED ECHOES

Wake



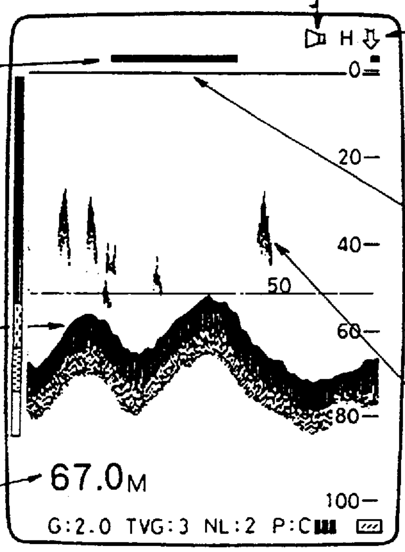
As the wake appears as a thick continuous line, it can be easily distinguished from a fish school. However, sounding beyond the wake becomes often difficult because of air bubbles in the wake.

Propeller Noise



When other ship is nearby, noise caused by revolution of propeller may appear as a thick line spreading radially.

VERTICAL SOUNDING MODE



ALARM MARK
It is displayed when the alarm function is turned on.

MINUTE MARK
Minute mark is displayed 30 seconds every minute.

TRANSDUCER
Color changes to red when the transducer is lowered and green when it is retracted.

TRANSMISSION LINE
It shows the transducer position i.e., ship's hull bottom.

SEABED
Generally it is displayed in reddish brown or red.

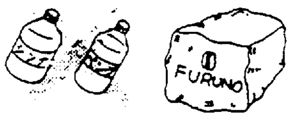
FISH SCHOOL
Size and color of echo give information on volume and density of fish school.

DEPTH
Seabed depth is displayed.

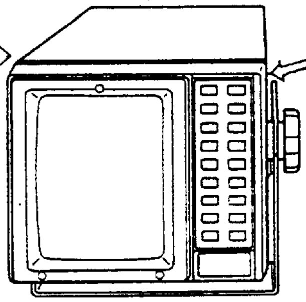
9. MAINTENANCE AND PERIODICAL CHECK

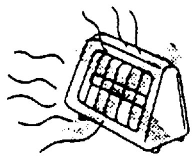
- Observing the following points will help to keep your CH-18 in top condition for many years.

Keep screen and filter clean ! Put on cover after operation.



Do not use thinner or benzine for cleaning. Use a damp and soft cloth.





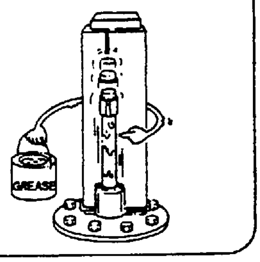
Keep heater away ! Allow room for ventilation.

⚠WARNING

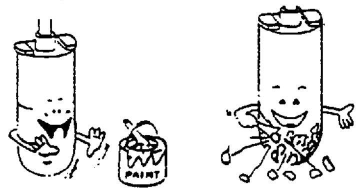
Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

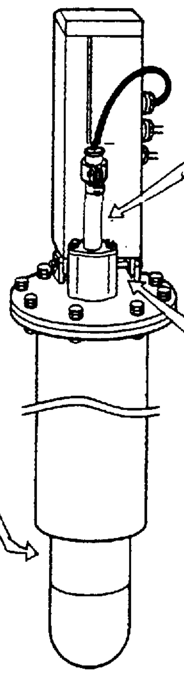
Apply grease to hull unit shaft periodically !



Keep soundome clean !

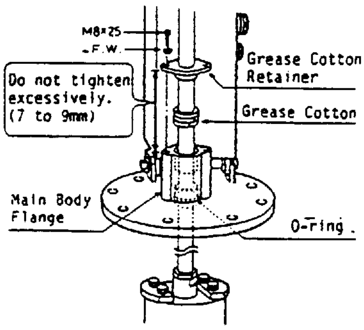


- Don't paint soundome.
- Carefully scrape off marine growth at dry-docking.



CH-181
(350mm Travel)

Tighten grease cotton retainer if water leaks thru main shaft.



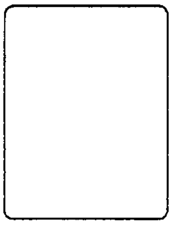
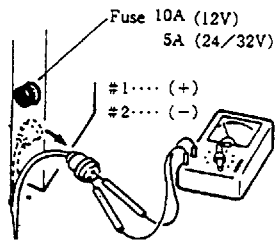
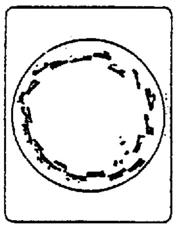
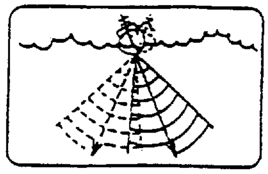
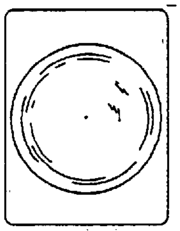
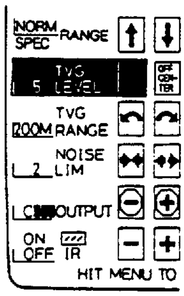
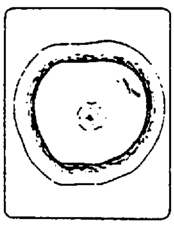
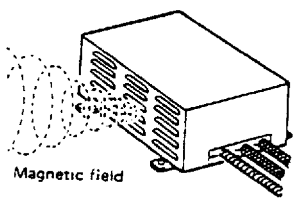
⚠CAUTION

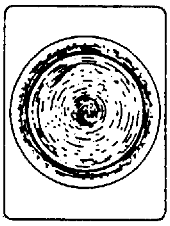
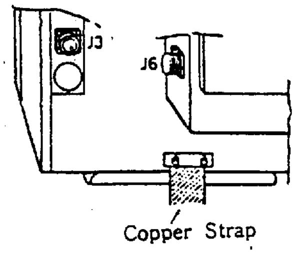
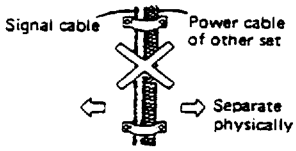
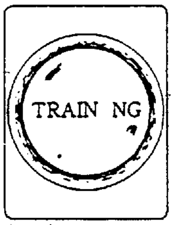
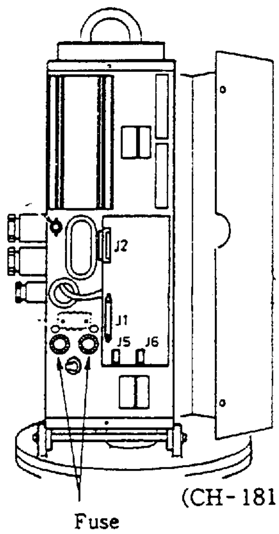
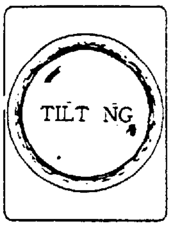
The zinc block attached near the transducer must be replaced yearly.

The junction between the transducer and main shaft may corrode, which can result in loss of the tansducer or water leakage inside the ship.

10. TROUBLESHOOTING

If your CH-28 seems faulty, look over the following check list. If proper operation cannot be restored, call for service, informing service personnel of the symptom and the result of the self-check shown on page 28.

Symptom	Check
 No picture	● Power supply is OK? Check ship's mains voltage at the power plug connected to the display unit. ● Fuse is OK? Replace the fuse if blown. Call service personnel if it blows again after replacement. 
 Bottom echo becomes irregular	● Sea is rough? Distance to seabed changes due to rolling and pitching. ● Long range is selected? Since receiving time is longer, ship's rolling and pitching are apt to effect detection of echo. 
 Feable echo	● Output power is set to "C"? Check the setting on the menu screen and set it to "C" (maximum output power) if not set so. ● TVG effect is excessive? An excessive setting of TVG results in disappearance of useful echoes. 
 distorted Picture	● Equipment generating strong magnetic field is sited nearby? Make sure that magnetic field generating equipment such as a rectifier is separated sufficiently from the display unit. 

Symptom	Check
 Noisy picture	● Equipment is grounded firmly? Carefully check the ground. ● Other cable is run along with signal cable? The signal cable may pick up noise emitted from the power cable of other equipment if they are too close to each other. Separate them if necessary. ● Seawater is dirty with floating debris? Reject unwanted echoes with the interference rejector, TVG or noise limiter function.  
 "TRAIN NG" appears	● No bearing signal comes from the hull unit. Message "TRAIN NG" means that the transducer is not rotating properly. Check the fuses in hull unit. If not blown, raise transducer, turn off power and call for service.  (CH-181)
 "TILT NG" appears	● No tilt signal comes from the hull unit. Message "TILT NG" means that the transducer is not tilting properly. Check the fuses in hull unit. If not blown, raise transducer, turn off power and call for service.

DIAGNOSTIC SELF-CHECK

The major circuits of the set can be checked with the self-check facility. If you suspect something is wrong with your set, turn off the set and turn it on again by pressing the [PWR] and GAIN [+] keys simultaneously, and the following self-check page is displayed. If any abnormality is found, call for service and report the check results to the service personnel.

[PWR] [+]
GAIN

```
            ** SELF TEST **
-MAIN CPU-                          -PANEL-
 0650045100                          *    0
 ROM        OK
 RAM        OK                       0    0
                                     0    0
-SUB - CPU-
 0650046100                          0    0
 ROM        OK
 RAM        OK                       0    0
                                     0    0
-VIDEO RAM-
 ECHO D0 : OK  D1 : OK  D2 : OK      0    0
 CHR        OK                       0    0
-MOTION SENSOR-                      0    0
 ROLL    + 12°
 PITCH   + 05°   —DIP SWITCH—         01
-TRAIN/TILT MOTOR TEST        COUNT 6

 TRAIN          NG    TILT           NG
 0 > 180  529   0     + 8 > 30  313  0
 180 > 0  541   0     30 > 93   454  0
 180 < 0  531   0     30 < 93   449  0
 0 < 180  539   0     + 8 < 30  319  0
```

● MAIN CPU/SUB CPU Check

Test of the memory chips that the built-in computers use. If faulty, "NG" (No Good) is displayed instead of "OK".

● PANEL Check

The numeral should change to "1" each time a key is pressed and held for one or two seconds..

● TILT MOTOR Check

Number of "NG" increases when the number of pulses used to tilt the transducer is incorrect. When it increases frequently, the set is faulty.

● TRAIN MOTOR Check

Number of "NG" increases whenever the number of pulses used to train the transducer is incorrect. When the NG number increases frequently, the set is faulty.

● MOTION SENSOR Check

Check of optionally supplied motion sensor. It is normal if the value changes with ship's rolling and pitching.

● VIDEO RAM Check

Test of memory chips that store video data to be displayed on the screen. If faulty, "NG" is displayed instead of "OK".

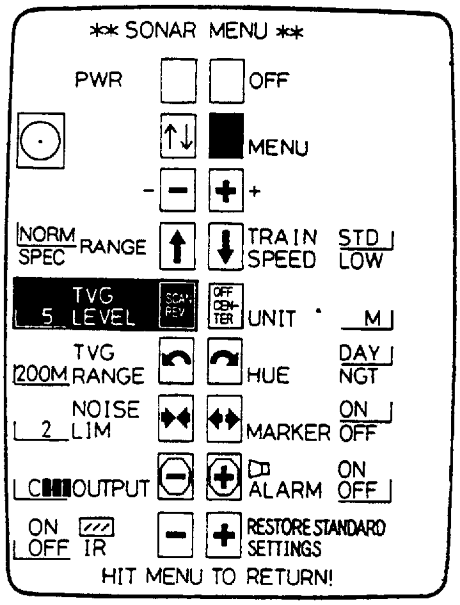
11. APPENDIX

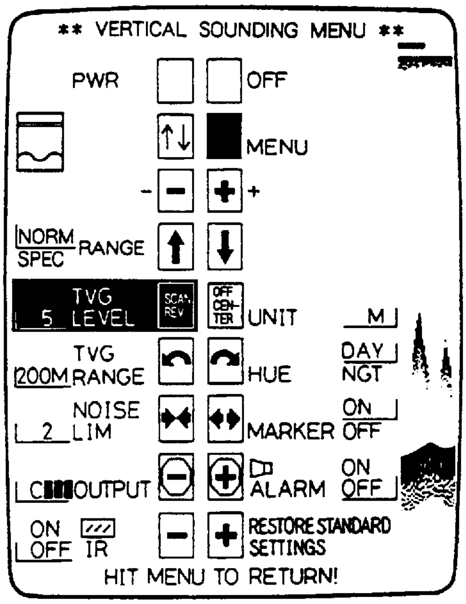
LIST OF FUNCTION OF CONTROL KEY

KEY	SETTING RANGE	SETTING STEP	BACKUP	INITIAL SETTING
XDCR			No	UP
MENU			No	Normal PPI
RANGE	10m～600m		Yes	
TILT	+5° ～90°	1°	Yes	
TRAIN	0° ～360°	6°	Yes	
SECTOR	6° ～360°	6° , 36° , 60° , 96° , 120° , 156° , 180° , 360°	Yes	
VRM	Within range scale in use.	Sonar Mode Range／120	Yes	
		Vertical Sounding Mode Range／200	Yes	
GAIN	0～10	0.5	Yes	
SCAN REV			No	
OFF CENTER		To the opposite of the seaching center.	Yes	

LIST OF MENU SCREEN SETTING

MENU	SETTING RANGE	STANDARD SETTINGS SONAR	STANDARD SETTINGS V／S	BACK-UP	REMARKS
TVG LEVEL	0～10	5	3	Yes	
TVG RANGE	25m, 50m, 100m, 200m, 400m	200m	50m	Yes	
NOISE LIMITER	0～10	2	2	Yes	
POWER REDUCTION	A, B, C	C	C	Yes	A : 8W B : 80W C : 800W
I R	ON, OFF	OFF	OFF	Yes	
UNIT	FA, FT, M, ヒロ	M		Yes	Common to Sonar and V／S modes.
HUE	DAY, NIGHT	NIGHT		Yes	〃
MARKER	ON, OFF	ON		Yes	〃
TRAIN SPEED		STD	×	Yes	
ALARM	ON, OFF	OFF		Yes	
RANGE	NORM, SPEC	NORM		Yes	





SPECIAL RANGE

MODE	RANGE (m)	1	2	3	4	5	6	7	8	9	10	11
		50	100	120	140	160	180	200	240	280	320	360
SONAR	Pulselength (ms)	0.5	1.1	1.4	1.5	1.7	2.1	2.3	2.7	3.3	3.5	4.1
V/S	Pulselength (ms)	0.4	0.7	0.8	1.0	1.3	1.4	1.8	2.1	2.1	2.3	2.5
	TX Interval (ms)	200	400	400	400	500	500	600	600	700	700	800

DIFFERENCE BETWEEN STANDARD AND LOW TRAIN SPEED

(Normal Range)

RANGE		10	20	40	60	100	150	200	250	300	400	600
TRAIN SPEED	STD (sec)	11	11	11	11	11	14	18	23	27	36	53
	Low (sec)	11	11	11	12	15	20	24	29	33	42	60

(Special Range)

RANGE		50	100	120	140	160	180	200	240	280	320	360
TRAIN SPEED	STD (sec)	11	12	12	13	15	19	23	25	29	31	33
	Low (sec)	13	14	16	19	21	24	26	28	33	36	40

SPECIFICATIONS

1. Display System : PPI and vertical display on 10-inch color CRT

2. Picture Color : 8 colors depending on signal strength

3. Display Mode :
   - Sonar mode
     PPI, PPI + historical displays are available.
   - Vertical sounding (V/S) mode

4. Range, Pulselength (P/L), Train Speed, TX Interval

MODE	Range (m) (Normal)	1	2	3	4	5	6	7	8	9	10	11
		10	20	40	60	100	150	200	250	300	400	600
SONAR	Pulselength (ms)	0.2	0.2	0.4	0.6	1.1	1.6	2.2	2.7	3.3	4.4	6.6
	Train Speed (S)	11	11	11	11	11	14	18	23	27	36	53
V/S	Pulselength (ms)	0.2	0.2	0.3	0.4	0.7	1.0	1.3	1.6	1.8	2.2	2.6
	TX Interval (ms)	100	100	200	200	400	400	500	500	600	700	830

Note 1. Unit for range scale can be selected among "meter" "feet" and "fathom".
2. Train speed can be changed to slower speed.
3. TX interval in sonar mode is every 6° transducer training.
4. Special Range can be selected on the MENU. See page 30.

5. Range Phasing : In steps of 1/5 of range for V/S mode.

6. Audio : 2W, 1.0kHz with external loudspeaker

7. Transceiver : Frequency : 180kHz
   Output Power : 800Wrms
   Beamwidth : 6.5° (−3dB point)

8. Training :

Train Sector	6°(Stop), 36°, 60°, 96°, 120°, 156°, 180°, 360°
Train Center	Can be set in any direction in 6° steps.
Train System	Continuous training or step-by-step training selectable

9. Tilt : +5° (above horizontal) to 90° (vertical) /10 seconds

10. Transducer Raise/Lower : CH − 181(350mm travel) ··· Raise/lower time, 30sec. approx.
    CH − 184(250mm travel) ··· Raise/lower time, 4sec. approx.

11. Allowable Ship's Speed : 15 knots

12. Other Functions : Motion Sensor : (Option) Stabilizes sounding beam against rolling/pitching of up to ±20°.
    Remote Control : (Option) Capable of controlling raise/lower, range, tilt, sector width, sector center direction and display mode.

13. Power Supply and Power Consumption : 12/24/32VDC, 110W (During raise/lower, 180W)
    100/110/115/200/220/230VAC, 50/60Hz, 1 ϕ
    (Rectifier RU-1746B-2 is required)

14. Environmental Condition : Ambient Temperature : 0℃ to 45 ℃
    Humidity : Less than 95%

EQUIPMENT LIST

CH-280 + CH-181 (350mm Travel type)

No.	Unit Name	Name	Type	Code No.	Q'ty	Weight (Kg)	Remarks
1	Display Unit		CH-280-E1		1	14	For 12VDC
			CH-280-E2				For 24/32VDC
2	Hull Unit	R/L Drive Unit CH-1842	CH-1811-1		1		For 12VDC
			CH-1811-2				For 24/32VDC
		Main Shaft	06-008-1021, L=1.17m	100-028-500	1		
			SHJ-0006, L=2.2m	661-000-061			
			06-007-1572, L=3.8m	600-715-720			
		Soundome Assembly CH-1812	CH-1812-1-24, 2.4mcable	006-541-550	1		For 12VDC
			CH-1812-2-24, 2.4mcable	006-541-580			For 24/32VDC
			CH-1812-1-35, 3.5mcable	006-541-560			For 12VDC
			CH-1812-2-35, 3.5mcable	006-541-590			For 24/32VDC
			CH-1812-1-52, 5.2mcable	006-541-570			For 12VDC
			CH-1812-2-52, 5.2mcable	006-541-600			For 24/32VDC
		Retraction Tank	06-013-2501, Steel, 1m	100-099-190	1		For 1.17m main shaft.
			06-013-2511, FRP, 1m	100-099-200			
			06-013-2502, Steel, 1.8m	100-100-320			For 2.2m main shaft.
			06-013-2521, FRP, 1.8m	100-100-340			
			06-013-2503, Steel, 3.5m	100-100-330			For 3.8m main shaft.
		Assembly Kit	CH-1815-11	006-541-430	1		For 1.17m
			CH-1815-22	006-542-090			For 2.2m shaft.
3	Spare Parts		SP06-00701	006-543-780	1		For Display
			SP06-00702	006-543-790			For Hull Unit.
4	Accessories		FP06-00900	000-065-056	1		
5	Installation Materials		CP06-00700, 10mcable	000-065-205	1		10m cable is supplied unless otherwise specified.
			CP06-00710, 15mcable	000-065-206			
			CP06-00720, 20mcable	000-065-207			
			CP06-00730, 30mcable	000-065-208			
6	Remote Control	CH-185	CH-185-E	000-085-030	1	0.38	
7	Motion Sensor	MS-100	with 10m cable	000-069-256	1	2	
8	Rectifier	RU-1746-B	RU-1746-B-2, AC110V	000-030-439	1	17	
			RU-1746-B-2, AC220V	000-030-440			

NOTES 1. See pages 36 for Hull Unit Assembly combination.
2. The units shaded by [shaded box] are optional supply.

EQUIPMENT LIST

CH-280 + CH-184 (250mm Travel type)

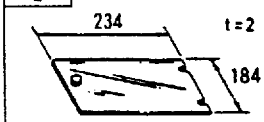
No.	Unit Name	Name	Type	Code No.	Q'ty	Weight (Kg)	Remarks
1	Display Unit		CH-280-E1	000-065-025	1	14	For 12VDC
			CH-280-E2	000-065-026			For 24/32VDC
2	Hull Unit	Control Box CH-1841	CH-1841-1	006-543-460	1	2.2	For 12VDC
			CH-1841-2	006-543-470			For 24/32VDC
		R/L Drive Unit CH-1842	CH-1842-1	006-543-480	1		For 12VDC
			CH-1842-2	006-543-490			For 24/32VDC
		Main Shaft	06-013-3211-0, L=48.5cm	100-151-380	1		
			SHJ-0006, L=2.2m	661-000-061			
		Soundome Assembly CH-1812	CH-1812-1-52, 5.2mcable	006-541-570	1		For 12VDC
			CH-1812-2-52, 5.2mcable	006-541-160			For 24/32VDC
			CH-1812-1-80, 8mcable	006-543-540			For 12VDC
			CH-1812-2-80, 8mcable	006-543-510			For 24/32VDC
		Retraction Tank	06-013-2501, Steel, 1m	100-099-190	1		For 48.5cm main shaft.
			06-013-2511, FRP, 1m	100-099-200			
			06-013-2502, Steel, 1.8m	100-099-320			For 2.2m main shaft.
			06-013-2521, FRP, 1.8m	100-099-340			
			06-013-2503, Steel, 3.5m	100-100-330			For 3.8m main shaft.
		Cable Assembly CP06-00403	06S-4054, 5m	006-543-980	1set		
			Copper Strap	006-543-250			
		Assembly Kit CH-1845	CH-1845-11	006-543-520	1		For 48.5cm shaft.
			CH-1845-22	006-543-530			For 2.2m shaft.
3	Spare Parts		SP06-00701	006-543-780	1		For Display Unit.
			SP06-00702	006-543-790			For Hull Unit.
4	Accessories		FP06-00900	000-065-056	1		
5	Installation Materials		CP06-00700, 10mcable	000-065-205	1		10m cable is supplied unless otherwise specified.
			CP06-00710, 15mcable	000-065-206			
			CP06-00720, 20mcable	000-065-207			
			CP06-00730, 30mcable	000-065-208			
6	Remote Control	CH-185	CH-185-E	000-065-030	1	0.38	
7	Motion Sensor	MS-100	With 10m cable	000-069-256	1	2	
8	Rectifier	RU-1746-B	RU-1746-B-2, AC110V	000-030-439	1	17	
			RU-1746-B-2, AC220V	000-030-440			

NOTES 1. See page 37 for Hull Unit Assembly combination.
2. The units shaded by [shaded] are optional supply.

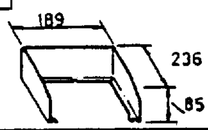
ACCESSORIES

No.	Name	Type	Code No.	Q'ty	Out-Line	Remarks
1	Filter Assembly	FP02-02920	002-140-010	1	1	
2	Hood	02-033-8001	203-380-010	1	2	
3	Loudspeaker	SC-05 WR	000-136-156	1	3	
4	Nylon Cover	06-017-1401	000-802-512	1	4	

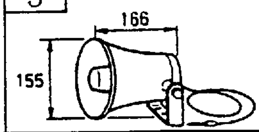
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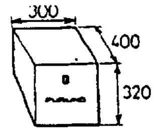
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3



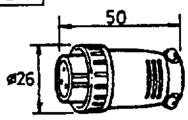
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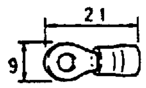
INSTALLATION MATERIALS

No.	Name	Type	Code No.	Q'ty	Out-Line	Remarks
1	Connector	NJC-203-PF	000-506-703	1	1	
2	Crimp-on Lug	FV2-3	000-108-424	5	2	
3	Copper Strap	WEA-1004-0	500-310-040	1	3	
4	Signal Cable Assy.	06S4055-0 *10m*	006-537-610	1		See note.

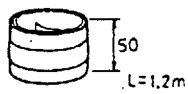
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2



3

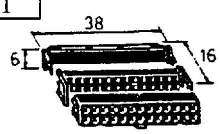


Note : 15m, 20m or 30m cable is optionally available.

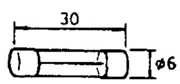
SPARE PARTS

No.	Name	Type	Code No.	Q'ty	Out-Line	Remarks
1	Connector	FRC2-A026-30S	000-115-760	1	1	For Display Unit.
2	Glass Tube Fuse	FGBO-A 5A	000-549-064	3	2	
3	Glass Tube Fuse	FGBO 10A, AC125V	000-549-065	3	2	
4	Hex. Wrench	Hex. size 3mm	000-830-131	1	3	
5	Glass Tube Fuse	FGBO-A 4A AC125V	000-127-233	3	2	For Hull Unit.
6	Glass Tube Fuse	FGBO 7A, AC125V	000-549-013	3	2	
7	Glass Tube Fuse	FGBO-A, 3A AC125V	000-549-063	3	2	
8	Ball Wrench	TWB-25	000-801-713	1	4	

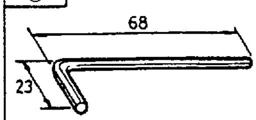
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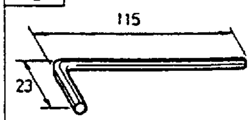
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3



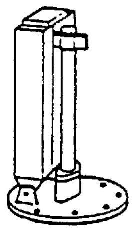
4



HULL UNIT ASSEMBLY COMBINATION

CH – 181 [350mm travel]

R/L DRIVE UNIT



Type	Code No.	Remarks
CH-1811-1	006-541-530	DC12V
CH-1811-2	006-541-540	DC24/32V

STANDARD	OPTION	

SHAFT



1.17m



2.2m

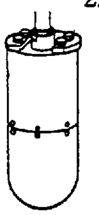


3.8m

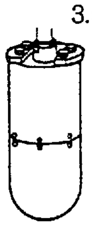
Type	Code No.	Type	Code No.	Type	Code No.
06-008-1021	100-028-500	SHJ-0006	661-000-061	06-007-1572	600-715-720

SOUNDOME

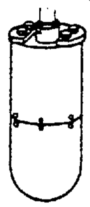
2.4m Cable



3.5m Cable

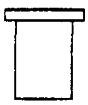


5.2m Cable

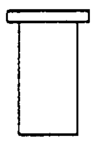


Type	Code No.	Remarks	Type	Code No.	Remarks	Type	Code No.	Remarks
CH-1812-1-24	006-541-550	DC12V	CH-1812-1-35	006-541-560	DC12V	CH-1812-1-52	006-541-570	DC12V
CH-1812-2-24	006-541-580	DC24/32V	CH-1812-2-35	006-541-590	DC24/32V	CH-1812-2-52	006-541-600	DC24/32V

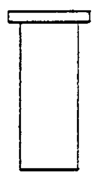
TANK



1m



1.8m

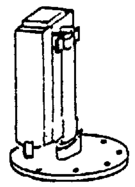


3.5m

	Type	Code No.		Type	Code No.		Type	Code No.
Steel	06-013-2501	100-099-190	Steel	06-013-2502	100-100-320	Steel	06-013-2503	100-100-330
FRP	06-013-2511	100-099-200	FRP	06-013-2521	100-100-340			

CH - 184 [250mm travel]

R/L DRIVE UNIT



Type	Code No.	Remarks
CH-1842-1	006-543-480	DC12V
CH-1842-2	006-543-490	DC24/32V

SHAFT

STANDARD



1.17 m

Type	Code No.
06-008-1021	100-028-500

OPTION



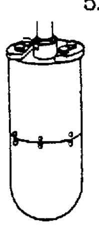
2.2m

Type	Code No.
SHJ-0006	661-000-061

SOUNDOME

STANDARD

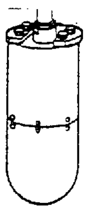
5.2m Cable



Type	Code No.	Remarks
CH-1812-1-52	006-541-570	DC12V
CH-1812-2-52	006-541-600	DC24/32V

OPTION

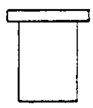
8m Cable



Type	Code No.	Remarks
CH-1812-1-80	006-543-540	DC12V
CH-1812-2-80	006-543-510	DC24/32V

TANK

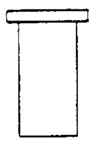
STANDARD



1m

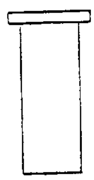
	Type	Code No.
Steel	06-013-2501	100-099-190
FRP	06-013-2511	100-099-200

OPTION



1.8m

	Type	Code No.
Steel	06-013-2502	100-100-320
FRP	06-013-2521	100-100-340



3.5m

	Type	Code No.
Steel	06-013-2503	100-100-330